

Name: Brooke Cannon

Project: X-Ray Backscatter Machine Support Frame

Mentor: Jeremy Parr

NASA Center: Kennedy Space Center

Introduction and Abstract

This summer at Kennedy Space Center, I spent 10 weeks as an intern working at the Prototype Development Lab. During this time I learned about the design and machining done here at NASA. I became familiar with the process from where a design begins in Pro/Engineer and finishes at the hands of the machinists. As an intern I was given various small jobs to do and then one project of my own. My personal project was a job for the Applied Physics Lab; in their work they use an X-Ray Backscatter machine. Previously it was resting atop a temporary frame that limited the use of the machine. My job was to design a frame for the machine to rest upon that would allow a full range of sample sizes. The frame was required to support the machine and provide a strain relief for the cords attached to the machine as it moved in the x and y directions. Calculations also had to be done to be sure the design would be able to withstand any loads or outside sources of stress. After the calculations proved the design to be ready to withstand the requirements, the parts were ordered or fabricated, as required. This helped me understand the full process of jobs sent to the Prototype Development Lab.

Goals and Purpose of the Project

The goal of my project was to learn the design process. The process began with customer requirements, followed by brainstorming solutions, analysis, and finished with machining and assembly. The most challenging part was learning how to use Pro/E to create my design. I spent ten weeks learning the program and I have just scratched the surface of its capabilities. It took time to learn the various approaches to building and assembly. Unfortunately, by not fully understanding Pro/E, I used some of the more complicated ways to design in Pro/E which led to many redesigns. Even though it took time, I did accomplish my goal of becoming proficient at

Pro/E. During the development of my project, I encountered every step of the design process. It began with the customer giving me the specific needs of what they wanted built. I sat down with my mentor to discuss the different ways of designing it while keeping the requirements in mind. I then performed the analysis, and gave the design to the machinists and helped with what I could. Another thing we had to consider when designing my project was getting the assembly to where it belongs. Due to the size of my project, we had to build it in separate parts and then build smaller assemblies to fit through a doorway. There are so many outside factors to be considered when designing.

I was given this project to not only learn about design, but also machinery. Knowledge of how to machine and build the parts of an assembly must be understood when designing it. The engineers at the Prototype Development Lab must be certain that every part of their design is possible to build. You may think that a certain feature of a part can be created easily, but the question is, can the machinists do it? And if so, do they have the proper tooling? There is much to take into account, especially since Pro/E doesn't prevent you from creating a ridiculously impossible part to make. There are also certain aspects that machinists must account for that must be included in a design, such as tolerances. Tolerances must be accounted for in all parts of the design to prevent any faults from happening because of the fits between parts. Threads must be properly sized to be sure that the bolt you've chosen will fit. While working on my project, I had to fit different types of holes that required more work than a normal tapped hole. One type was a blind hole which required it be tapped with two different types of taps so that the threads would reach the bottom of the hole. There were many aspects of my project that I had to make modifications to after seeing it from the machinist's perspective.

Being able to learn from an engineer and a machinist provided me with more knowledge than I ever could have asked; I learned so much from seeing it from both ends. There are so many advantages that the Prototype Development Lab has over other machine shops, beginning with the relationships within the lab. Knowing your coworkers makes the environment much more pleasing to work in and allows the outcome of quality products.

Impact of MUST Internship on Career Goals

Math and science, although challenging, have created a determination within me to reach achievements that seemed beyond my reach. The direction for my career was set before the MUST internship began, but once again, I have seen possibilities that I never before considered. Although I am an Industrial and Systems Engineering major, my internship placement was in the field of Mechanical Engineering in the Prototype Lab. I gained experience as a design engineer through the guidance of my mentor and the other Prototype Lab engineers.

My internship assignment presented me with the task of satisfying the customer by meeting the set requirements for the project. However, I was surprised with the amount of control I was allowed for the functionality of the design as well as the aesthetic aspect. Making sure that the design satisfies the customer first and foremost is of extreme importance, but the realization that an engineer is allowed such creativity was something I wasn't expecting. Completing this goal has broadened my horizons and forced me to look at my strengths and recognize the opportunities available to me.

The location of my internship has greatly influenced my career goals. The current NASA programs and the history of Kennedy Space Center are fascinating and have inspired me to share my experiences with everyone I meet. Visiting the Apollo landmarks and seeing all the aspects

of the Space Shuttle program turned my dream of a career at NASA into my ultimate goal. My desire to become part of NASA is fueled by the passion that I have come to see amongst all the NASA employees.

The employees at the Prototype Lab have made a direct and significant impact on my career goals. Whenever the opportunity was available, they would take me to tour the many areas of KSC. They would always take the time to explain the importance and the different aspects of the work at each facility so I could learn about the many careers at NASA and their significance. Every individual at the Prototype Lab is so incredible and I am so grateful for all they have taught me this summer. They taught me not only about engineering, but about working as a team. They spent countless hours teaching me and allowing me to gain the most out of this experience. I feel certain that I had the best mentor, worked with the most incredible people and gained an experience more than most could ever imagine. This has been the best internship, the best summer, and the best time of my life.